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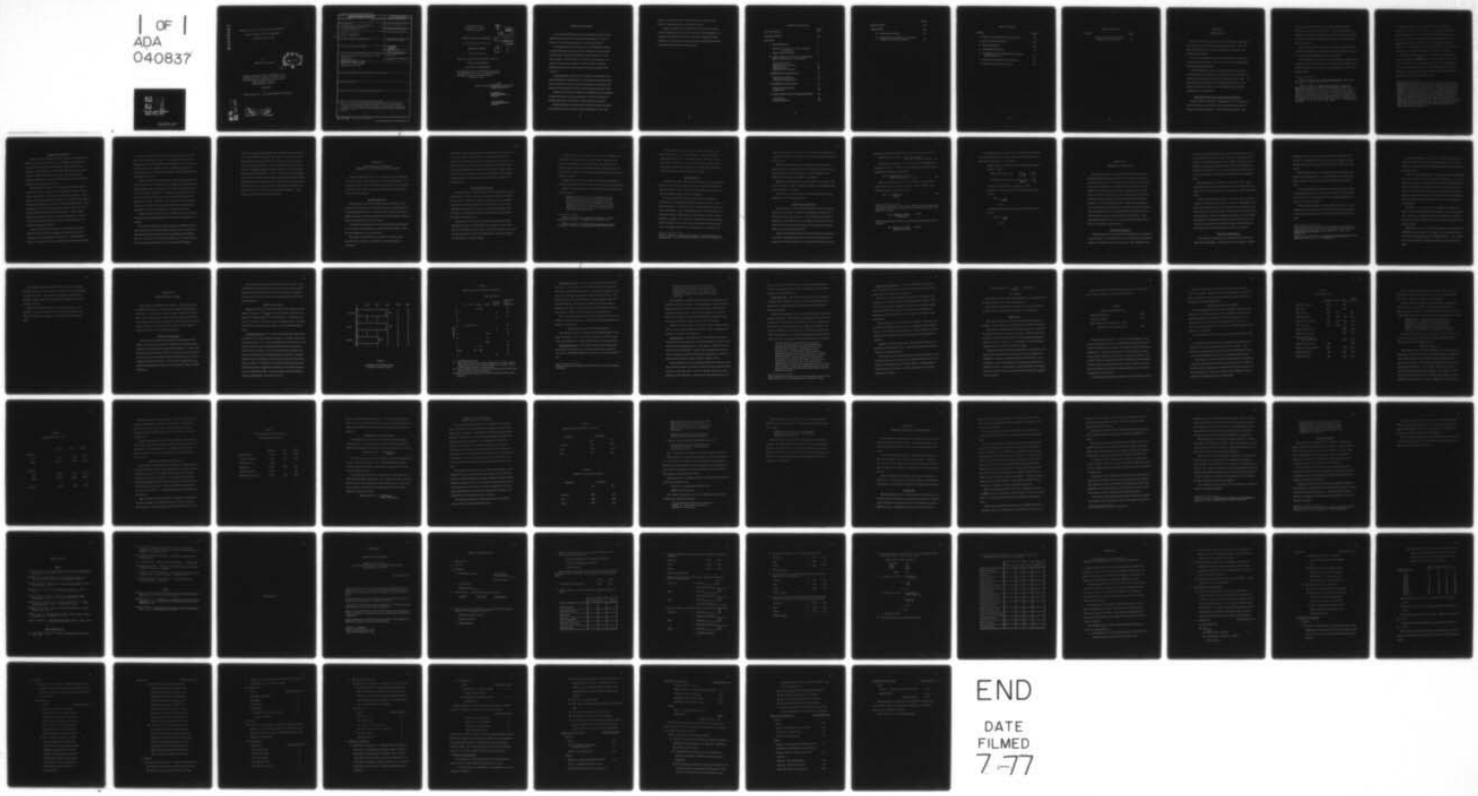

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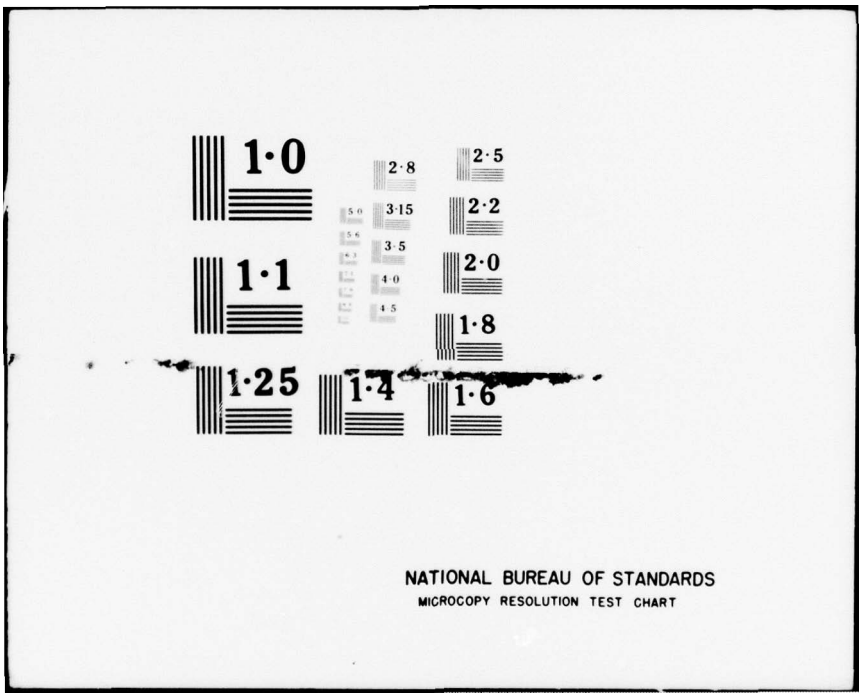
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PERSONAL, REST, AND DELAY ALLOWANCES IN THE DEPARTMENT OF DEFENSE A CRITICAL ANALYSIS

by

Robert Joseph Howard

A thesis submitted in partial fulfillment of the requirements for the degree of Masters of Arts in the Department of Business Administration in the Graduate College of The University of Iowa

June 1969

Thesis supervisor: Professor Clifford M. Baumback

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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE *(and Subtitle)* Personal, Rest and Delay Allowances In the Department of Defense, A Critical Analysis.	5. TYPE OF REPORT & PERIOD COVERED Master's thesis,
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Robert Joseph Howard	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE June 1969
	13. NUMBER OF PAGES ~~68~~ 77 p.
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)* Defense Industrial Resources Support Office Dwyer Bldg Cameron Station Alexandria, Virginia 22314	15. SECURITY CLASS. *(of this report)* Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*
Approved for Public Release
Distribution Unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*
This is a study of current policies and procedures in the Department of Defense for determining and applying personal, rest and delay (PR&D) allowances in its manufacturing, maintenance, and warehousing operations. The study reflects a need for more uniformity within the work measurement program.

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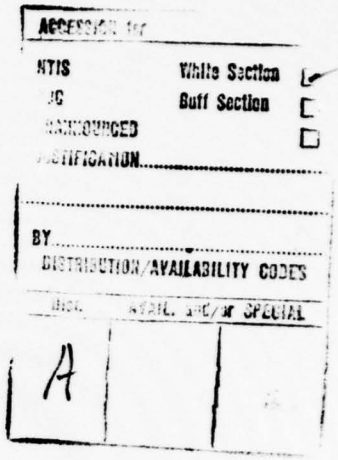

CERTIFICATE OF APPROVAL

MASTER'S THESIS

This is to certify that the Master's Thesis of

Robert Joseph Howard

with a major in Management

has been approved by the Examining Committe
as satisfactory for the thesis requirement for
the Master of Arts at the convocation
of June 6, 1969

Thesis committe: C. M. Baumback
Thesis supervisor

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ACKNOWLEDGEMENTS

I am deeply indebted to the work measurement analysts in the Department of Defense who made this study possible. Their response to the survey questionnaire is greatly appreciated.

I am especially grateful to the U. S. Army Management Engineering Training Agency, Rock Island, Illinois for the opportunity to pursue this study and to complete the requirements for my advanced degree. Special thanks are due Mr. A. Lynn Bryant, Mr. James O. Jensen, Mr. Donald J. Porter, and Mr. William S. Shallman whose patience and counsel were so necessary for this research.

I am particularly indebted to Dr. Clifford M. Baumback, Professor of Business Administration, who provided the needed inspiration, constructive criticism, and encouragement. His counsel and guidance were invaluable to the successful completion of this study.

Thanks also are due Mr. Edward P. Kindinger for his assistance in summarizing the survey questionnaires, and to Mr. Richard J. Schonberger for his most helpful criticism of the manuscript.

Special thanks go to the women who typed the numerous preliminary drafts as well as the final version of this study: Mrs. Elva

Baldwin, Mrs. Donna Gulley, Mrs. Mary Hull, and Mrs. Lois Keller. Their assistance is greatly appreciated.

Finally, thanks go to my wife Loretta, and our four children, Valerie, Michael, Daniel, and Julie for their understanding and encouragement throughout this study. My wife's editing and typing assistance in various stages of the manuscript added immeasurably to the successful completion of this study.

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CHAPTER I

INTRODUCTION

This is a study of current policies and procedures in the Department of Defense for determining and applying personal, rest, and delay (PR&D) allowances in its manufacturing, maintenance, and warehousing operations.

The study reviews the practices of the five major components of the Department of Defense: Army, Navy, Air Force, Marine Corps and the Defense Supply Agency.

A critical analysis of these practices is made for the purpose of determining the principal factors responsible for the differences in these policies and procedures and the resultant factor values. The desirability and practicality of developing uniform policies, procedures, and factor values for use by all Department of Defense installations is also evaluated.

The Need For Personal, Rest and Delay Allowances

Since the advent of Scientific Management, the use of scientifically determined time standards for work has been a necessary ingredient of good management. Frederick Winslow Taylor, often

called the father of Scientific Management, said that the most important cause of poor management is: "The profound ignorance of employers and their foremen as to the time in which various kinds of work should be done, and [that] this ignorance is shared largely by the workmen."[1]

His concern with determining the proper time in which various kinds of work should be done led to his development of time study, a work measurement technique still in wide use today.[2]

Work measurement is concerned with developing a realistic time in which a task can be completed. The determination and application of PR&D allowances is necessary to the development of any time or output standard.

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[1]Taylor, Frederick W., Scientific Management, Harper and Brothers, New York, 1947, p. 30.

[2]Barnes, Ralph M., Motion and Time Study: Design and Measurement of Work, 5th Ed., John Wiley & Sons, Inc., N. Y., 1963, p. 10. Mr. Barnes observes "It is generally agreed that time study had its beginning in the machine shop of the Midvale Steel Company in 1881 and that Frederick W. Taylor was its originator." Cited by the Sub-Committee on Administration of the ASME, "The Present State of the Art of Industrial Management," Transactions of the ASME, Vol. 34, pp. 1197 - 1198, 1912.

In the stop watch time study procedure, for example, the observed (average) time is "leveled"[3] to correspond to the time in which a trained worker can complete a task while working at a normal effort. This time is usually determined by relatively short duration time studies. For this reason the retarding effects of fatigue and the work stoppage caused while attending to personal needs, and other interruptions will not have been taken into account.

Any reason which justifiably prevents such ideal performance is cause for adjusting the ~~normal~~ package time to a more realistic figure. If a worker is observed over a long period of time, many interruptions may be controllable by the worker, while many of them are beyond his control. For this reason it is customary to make an addition to the normal time to allow for these delays.

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[3]The effort which a worker exerts while performing a task varies throughout the work day. Thus, when he is observed, he may not be working at the normal effort for that task. The analyst must make a judgment as to the percent (either higher or lower) of normal effort at which the worker is working. If this pace is below normal the observed time will be higher than normal and will be adjusted downward. If, on the other hand, the worker is exerting above normal effort, the observed times will be lower than normal and will be adjusted upward. For example, if the worker is judged to be working at 10% above normal performance, the observed time is increased by 10%. This process is called "leveling" and the adjusted time is called the normal or base time.

Background of the Study

In 1917, Congress appended a rider to the annual Appropriations Bill specifically prohibiting the use of mechanical timing devices to improve the efficiency and effectiveness of Federal Government activities. The restriction continued until 1949 when, as a result of the Hoover Commission studies, the rider was eliminated and Federal departments and agencies were directed to establish formal management improvement programs.

The Department of Defense, along with other Federal departments and agencies, cautiously inaugurated work measurement programs as part of their management improvement programs. Lacking the industrial engineering capabilities to develop these programs, the commands employed a number of consulting organizations. These programs were first introduced in those types of activities in which private industry had already proven their value. This included industrial type activities such as arsenals and shipyards. Quasi-industrial operations such as maintenance and warehousing were included during the mid-1950's.

The work measurement programs within the Department of Defense have been slow in developing, primarily as a result of management not recognizing its potential use. Private industry, however, has long recognized the importance of work measurement

as a means for determining the standard time required to perform a task. The resultant work measurement standards have been used advantageously in many industrial establishments for: (1) estimating the time and costs to complete a task, (2) scheduling production, (3) balancing the work of men and machines, and (4) determining and controlling labor costs.

In 1962, the Director of Productivity Engineering in the Office of the Assistant Secretary of Defense for Installations and Logistics put his full support behind the attainment of maximum economical use of work measurement standards. A deterrent to improvement in the work measurement programs is the lack of uniformity among the programs of various commands. One of the reasons for this lack of uniformity is the different modus operandi of the many consulting organizations which were employed to develop the programs.

At the present time there is still no uniform policy or procedure for determining and applying PR&D allowances in the Department of Defense.

The need for a study of the PR&D allowances within the Department of Defense became particularly apparent with the advent of the Warehousing Gross Performance Measurement System (WGPMS). This is a system for measuring the performance of all major Department warehousing installations in the continental United States.

The work measurement standards in this system utilized a standard or "constant" PR&D allowance. The services, however, each felt that the allowance should be the same as they use in their internal work measurement program. It was evident from these discussions that there is little uniformity of policies and procedures concerning PR&D allowances among the services. Further on-site investigation by the Director of Productivity Engineering revealed that the policies and procedures varied significantly not only among the services, but in many instances, among commands and installations within a particular service and among activities within an installation. This study is an outgrowth of these observations.

CHAPTER II

THE NATURE AND SCOPE OF PERSONAL, REST AND DELAY ALLOWANCES

A common definition of terms is important to insure uniformity in the determination and application of each type of allowance. For the purpose of this study the definitions and scope of these allowances are given below. The common methods of determining these allowances are also discussed.

Personal Allowance

This allowance takes into consideration the fact that a worker cannot work continuously over long periods of time without attending to certain biological needs. Therefore, time is allowed in the production standard to attend to such personal needs as getting a drink of water and making trips to the rest rooms.

Personal time requirements, although variable with individuals, are not related to job difficulty or environmental conditions. Hence, the same allowance is made on all jobs.

The nature of personal time has made measurement of the amount of time actually needed difficult, if not impossible, to determine.

The amount of time actually allowed for personal needs is determined by several means. It may be made by management decision, in which case, an allowance considered adequate for the average man is given for all jobs. The unions often negotiate with management as to the amount of personal time which is to be granted. Another often used means is to measure, by production or work sampling studies, the proportionate amount of personal time which is actually taken by the workers.

Rest (Fatigue) Allowance

Unlike allowances for personal time, those for rest do vary with job difficulty and with environmental conditions (such as excessive heat or cold). Therefore, allowance must be made in any production standard or work assignment for the worker to recover from physical or psychological weariness caused by the difficulty of the job and by environmental working conditions that adversely affect his ability to perform work.

Fatigue has received more attention than personal and delay allowances because of the difficulty of measuring it. Since World War I many studies have been made, not only by industrial engineers but also by students of many other disciplines, such as psychology and physiology, to measure fatigue.

These efforts have led to the development of a scientific field of study which has become known as ergonomics. Ergonomics has involved considerable research into the problem of fatigue with emphasis on the worker as a human machine. However, it has not yet produced a solution that is considered practical for measuring the fatigue of workers.

Niebel points out that the inability of the industrial engineer to accurately measure fatigue has made it an area for union negotiations.[1]

Buffa also draws attention to the industrial engineer's inability to measure fatigue.[2]

> Unfortunately we still lack an accepted framework for the establishment of rest allowances based on any rational or scientific measurements. In most instances, schedules of fatigue allowances for various types of work are used based on general acceptability and are often the subject of agreements between labor and management.

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[1]Niebel, Benjamin W., Motion and Time Study, 4th Ed., Richard D. Irwin, Inc., Homewood, Ill., 1967, p. 321.

[2]Buffa, Edward S., Models for Production and Operation Management, John Wiley and Sons, Inc., New York, 1966.

Many companies have from long experience arrived at rest allowances which seem to be satisfactory.[3] Other companies, by management decision or by union negotiations, provide organized rest periods. Perhaps the most common plan is to allow one rest period in the middle of the first half of the work shift, and another in the middle of the second half of the work shift.

Delay Allowance

The delay allowance, like the rest allowance, varies among jobs. However, in the rest allowance the concern is with the slowdown of the worker due to fatigue, but in the delay allowance the concern is with interruptions which cause work stoppages.

In every job there is some interference which prevents the worker from working continuously throughout the work day. Some of this interference is controllable by the worker (avoidable delay), but some is beyond his control (unavoidable delay). This allowance provides time for those delays that he cannot control, such as machine breakdown, running out of material, waiting for servicing equipment (cranes, forklifts, etc.), and receiving instructions from the supervisor. Each delay should be reviewed and every reasonable effort

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[3] Barnes, Ralph M., Motion and Time Study: Design and Measurement of Work, 5th Ed, John Wiley & Sons, Inc., N. Y., 1963, p 402.

made to eliminate it, but where it is not practical or economical to eliminate the delays, an allowance in the time standard or work load must be made.

This allowance is the easiest of the three to measure, since work stoppages can easily be observed. The analyst must, however, determine the cause of the stoppage and make a judgment as to whether the allowance is avoidable or unavoidable.

Management normally places an upper limit on the length of delay to be allowed. Delays beyond this length are then reported separately for purposes of control.

The amount of these delays is typically determined by making production or work sampling studies.

Application of Allowances

Once the personal, rest and delay allowances have been determined, it is customary to add them all together and apply them to the normal time as one allowance. The allowances are normally applied by an allowance factor or multiplier by which the task normal time is increased by the amount of time required for personal needs, rest, and unavoidable delays.

There are three different procedures for arriving at the allowance factor, depending upon the form in which the allowances are expressed. When the allowances are expressed in minutes per day

the proper method of arriving at the allowance factor is as follows:

$$\text{Allowance Factor (AF)} = 1 + \frac{\text{Allowance Minutes}}{480 \text{ min} - \text{Allowance Minutes}} \quad (1)$$

Sometimes the allowances are expressed as a percentage of the total work day (Pw).[3] In this case the allowance factor is derived by applying this variation of formula (1):

$$AF = 1 + \frac{\text{Allowance percentage}}{100\% - \text{Allowance percentage}} \quad (2)$$

In some organizations it is common practice to express the allowances as a percent of the productive work day (Pp).[4] This results in equation (1) taking the form:

$$AF = 1 + \frac{\% \text{ Allowance}}{100\%} \quad (3)$$

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[3]The following formula can be used to convert allowances expressed in minutes to allowances expressed as a percentage of the work day, (Pw) or vice versa:

$$Pw = \frac{\text{Allowance minutes}}{480 \text{ minutes}} \times 100\%$$

[4]The conversion from minutes to percent of production time (Pp) is made by:

$$Pp = \frac{\text{Allowance minutes}}{\text{Productive minutes}} \times 100\%$$

It is important for the accuracy of the standard that consistency be maintained between the method of calculating the allowance and the method of applying it. For example:

Assume that the total allowances are 72 minutes per total work day. This is

15% of the total work day $\left[\frac{72}{480} \times 100\right]$

17.6% of the productive work day $\left[\frac{72}{480-72} \times 100\right]$

Assume also that the delay is published as 15%.

An analyst using formula (2) will get an allowance factor of 1.176.

$$AF = 1 + \frac{15}{100-15}$$

$$= 1.176$$

An analyst using formula (3) will get an allowance factor of 1.15.

$$AF = 1 + \frac{15}{100}$$

$$= 1.15$$

CHAPTER III

RESEARCH METHODOLOGY

Data for this study were obtained from two basic courses, (1) the published policies and procedures of the various services and command headquarters, and (2) the survey questionnaire which was used to gather information concerning the actual development and application of PR&D allowances at the installation level. A third research method, the field study, was considered since it provides benefits through personal interviewing which cannot be obtained through the use of questionnaires alone. However, the population size and its geographical dispersion made this approach prohibitive. The questionnaire, however, has the advantage of allowing the person being interviewed to respond at his own convenience. Also, questionnaire data are likely to be more objectively analyzed since there is no personal contact involved.

The Survey Population

The questionnaires were mailed to 60 installations in the Department of Defense. The installations were chosen through coordination with the commands and services concerned. This coordination was

necessary to insure that those surveyed had established work measurement programs and also to obtain approval to mail the questionnaires to the installations under their command. Approval was obtained to mail the questionnaires directly to 30 of the installations. The other 30 questionnaires were mailed to the commands involved for their review prior to mailing the questionnaires to the installations.

The questionnaires (see Appendix A) included a cover letter explaining the purpose of the questionnaire, and a postage-paid and return-addressed envelope in which to return the completed questionnaires.

Of the 60 questionnaires mailed in the study, 43 were returned completed, and one negative reply was received. Although the cover letter stated that the identity of the cooperating organizations would not be disclosed, the questionnaire required that the respondent name his organization. Of the 17 questionnaires which were not returned, investigation revealed that 10 of these had been mailed to the same command for distribution, and that the Reports Control Office of that command would not authorize the collection of the data.

The Survey Questionnaire

The design of a questionnaire is important to the successful gathering of information. People will be more willing to complete

a questionnaire if it is easy to understand and is not too time consuming[1]. The questionnaire does not require any lengthy answers. Each question can be completed either with a check mark or a short answer.

Nearly all authorities on questionnaire design recommend pretesting of the questionnaire[2]. The questionnaire was reviewed by fellow employees to insure its adequacy in collecting the desired data.

Also to insure that the questionnaire could be completed within a reasonably short time, it was tested on a class of work measurement analysts. Each member of the class completed the questionnaire in less than 30 minutes.

The survey questionnaire consisted of 15 short-answer or check-off questions and a place for any pertinent comments the respondent wished to make pertaining to the study but not covered by the questions.

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[1]The comments on this section on the importance of good design of the questionnaire is discussed in greater detail in Mildred Parten's Survey, Polls, and Samples, Rogers Litho Inc., Texas, 1959, Chapter VII.

[2]Ibid; also see Goode and Hatt, Methods in Social Research, McGraw Hill Book Company, N. Y., 1952 Chapter 12.

Although installations were not to be identified in the study, the respondent was asked for this information (Question 1). This permitted the identification of the installations which did not respond, as previously noted.

Since the technical competence of the respondent is an important factor in the quality of the answers given, questions 2, 3, and 4 were designed to obtain some indication of the respondent's qualifications. Question 4, relating to the respondent's work experience, was simplified by requiring only that information be supplied on industrial engineering experience and the number of years of such employment; neither the dates of employment nor the names of employing firms was requested.

Questions 5, 6, 7, 9, and 10 were designed to determine the nature of the policies and procedures actually in use by the installation. These data, coupled with the data from question 1, indicates the extent to which subordinate installations follow command policies and procedures.

Questions 8, 11, 12, 13, and 14 were included to determine if the installation-level personnel are receptive to a uniform Department of Defense policy and procedure on PR&D allowances. The respondents were also asked to evaluate the allowances presently being made.

The method of application of PR&D allowances is as important to the success of a work measurement program as is the development of proper allowances. Question 15 was designed to determine the methods actually being used to incorporate such allowances in work standards or loads.

Because it is difficult to design a questionnaire which is all-inclusive, a place was provided for the respondent to include any comments which he felt might have a bearing on the subject under study.

CHAPTER IV

FINDINGS AND ANALYSIS

This chapter is divided into two sections. The first section is an analysis of the policies and procedures prepared and published by services and commands for their respective subordinate installations. The second section is an analysis of the policies and procedures actually followed by the installations and the extent to which they deviate from those furnished by the commands. This analysis is based on responses to the survey questionnaire.

Services and Commands

The services have followed the lead of the Department of Defense by allowing each command to develop its own policies and procedures for determining and applying PR&D allowances. This decentralization of Department of Defense work measurement responsibility has resulted in many different policies and procedures for determining and applying allowances. Thus, there is today little agreement in the Department of Defense as to the proper content of PR&D allowances.

These differences can be attributed to two major causes: first, the different approaches which the commands have taken to provide guidance to the installations, and second, the different interpretations given to the terms as well as the scope of personal, rest and delay allowances.

Different Approaches

Eleven of the twelve commands included in this study have taken either the "policy" (or "constant") approach or the "procedure" approach to the determination of PR&D allowances. In the latter approach, allowances are determined from prepared tables. The other command has not provided any guidance to its subordinate installations.

Constant Allowances. The most common approach (used by five commands) is to provide separate standard, or constant, allowances for personal needs, rest, and unavoidable delays (see Figure 1). Two other commands provide a single standard allowance for personal needs and rest combined. Only one of these seven commands does not allow deviation from the stated allowances; the other commands authorize their installations to deviate when justified by local conditions (see Table 1). Allowances in six of the commands range from local determination for all delay allowances to local determination only for specific situations, such as changing into special clothing, extreme temperatures, and excessive noise.

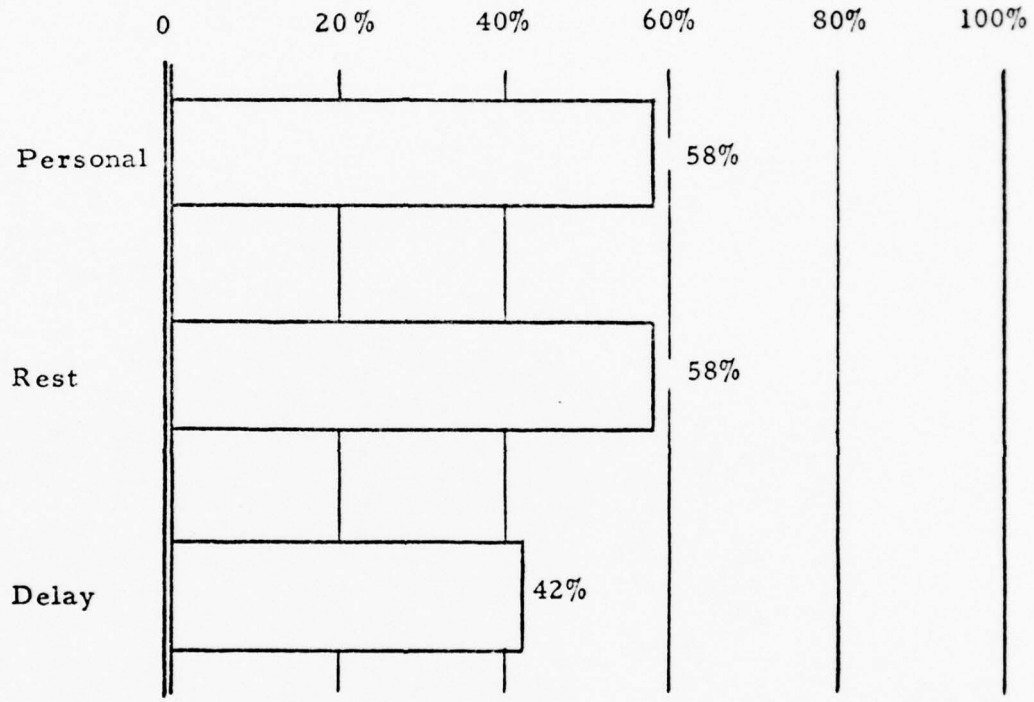

Figure 1

Percentage of Commands Using
Constant Allowance Values

Table 1

Summary of Command Policy Allowances

	Command Policy						
	P	R	D	P&R	PR&D	Variable Tables	Authorized Local Supplement
COMMANDS A				10.4%			X
B						X	X
C						X	X
D*							
E	4%	6.7%	5%				X
F						X	X
G					15%		X
H					**		
I					15%		X
J				***			X
K****			5%	10%			X
L						X	X

* No guidance furnished.

** This command provides constant allowances by crafts. These range from 16% for a one man operation in one craft to 44% for a multi-man operation in another craft.

*** This command provides a constant 9% allowance for inside shops and 14% allowance for outside shops.

**** This command provides a 2% cleanup allowance for blue collar workers.

Tabular Allowances. The second approach, used by four of the commands, is a procedure[1] utilizing tabular values for determining allowances at the various installations. Tables are included for each of the three allowance categories: personal, rest, and delay. The values in these tables are expressed as a percent of the total work day (480 minutes). The procedure authorizes the installations to supplement the tables where tables have not been included to cover the situation. This procedure is reproduced in Appendix B.

Three of the commands using the procedure make its use by subordinate commands mandatory. The fourth command publishes it for guidance purposes only.

Different Interpretations of PR&D Allowances

The commands differed considerably in the interpretation of the terms "personal", "rest", and "delay" allowances, and also in the scope of the allowances. These differences are summarized below.

Personal Allowance. The common interpretation of this allowance is that it provides time for personal needs, such as trips to rest rooms and drinking fountains. However, one command defines it as:

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[1]This procedure was originally developed by the Air Force Logistics Command.

> The time required when the operator finds it necessary to stop work for personal reasons, such as getting a drink of water, making a trip to the lavatory, personal conversation, smoking a cigarette, making a trip to the bank or credit union, etc.

The procedure in Appendix B also contains an inconsistency regarding "personal" allowances. In that procedure, personal time is defined in accordance with the accepted definition. However, the actual allowance included in the tables in Appendix B are for two breaks of ten minutes each and for environmental conditions, both of which are normally considered to be "rest" allowances.

Another command includes "rests from sawing or other manual effort" as an example of personal allowance. This is properly and logically a part of the rest allowance.

Rest Allowance. The explanation most commonly used by the commands for this allowance is that it provides time to recover from physical and psychological fatigue. The degree to which the term is defined varies considerably, ranging from no definition whatsoever to the detailed list of factors enumerated in Appendix B, which even provides allowance for wearing restrictive safety devices.

Fifty-eight percent of the commands combine this allowance with the personal allowance or with both personal and delay allowances and provide one allowance value. These commands either fail to give a definition of the allowance or describe it in very general terms, as

above. One of these commands gives a constant rest allowance of 6.7 percent, but describes the scope of the allowance as providing for policy breaks and clean-up.

Delay Allowance. Five of the commands provide a standard or "constant" delay allowance. However, all but one authorizes the installations to supplement the allowance for conditions unique to their organizations.

Detailed descriptions of the scope of this allowance are given by only two commands, except for those using the procedure described in Appendix B. One of these commands cites extreme conditions of heat and noise as factors in this type of allowance, though they are normally included in "rest" allowances. The other command has included items which are normally considered non-available time.[1] This command's interpretation of the delay allowance is as follows:

> The delay allowance provides the time required for common administrative and unavoidable delays and the set-up and shut-down required at the start and end of the work day. Illustrations of these delays include: approved trips to the dispensary, industrial relations office and security office, management interruptions such as announcements on public address system, officially authorized meetings and ceremonies, fire and air raid drills, solicitations for official drives and collections, and similar delays. Other delays are minor work interruptions such as making minor repairs to equipment, picking up dropped material, taping a torn paper, and all other similar delays that come under this category.

[1] Non-available time is that time in which the worker is at work but during which time he is not available to do productive work.

Application of Allowances. As stated in Chapter II, consistency must be maintained between the method of determining the allowances and the method of applying the allowances.

The tabular values contained in the procedure in Appendix B are expressed as a percentage of the total work day (480 minutes). However, the procedure is inconsistent in that it uses a method of applying the allowance which requires allowances to be expressed as a percentage of the productive day. (See formula 3 in Chapter II and Appendix B).

Two commands providing standard or "constant" allowances state only that the allowances are applied as a percentage of the productive time, but do not illustrate the application nor state whether the values allowed are a percentage of the total work day or of the productive work day.

Another command illustrates the conversion from minutes to a percentage of the productive day. However, the conversion for each allowance is made separately.

The figure used for the productive day, in this command, is computed separately for each category by subtracting the allowance minutes for each category from the total work day. By that method a rest allowance of 30 minutes would be converted to a percentage allowance as follows:

$$\text{Percent Allowance} = \frac{30}{480-30} \times 100 \text{ percent}$$

$$= 6.7 \text{ percent}$$

The divisor (480-30) is not the productive day, since the personal and delay allowances have not been subtracted.

The method of application for the other commands was clearly consistent with the method of development of the allowances.

Installations

The 43 respondents to the questionnaire indicated an almost complete lack of consistency in the development of PR&D allowances.

Generally, the installations followed the procedures and policies recommended by their respective commands. Where the use of the procedure in Appendix B is mandatory by subordinate installations, it has been utilized. However, one installation used it to develop a constant allowance which is applied to all tasks.

Only three of the installations indicated that the standard or constant allowances furnished by the commands is used without local adjustment. Although a standard allowance is furnished by seven commands, it is not interpreted by all subordinate installations as mandatory for use. For example, of eight installations responding from one command, only four use the standard allowance suggested by the command.

The respondents were asked to indicate the source of their allowances. Their responses are summarized in table 2.

Table 2

Source of PR&D Allowances

Higher Headquarters	28%
Local Development	54%
Other (combination of both above, other service's data, consultants, etc.)	18%

The percentages in Table 2, however, are misleading, since 19 of the 43 respondents (44 per cent rather than the 28 per cent shown in Table 2) had mandatory policies or procedures furnished by higher headquarters. This discrepancy of 16 per cent (44 per cent minus 28 per cent) is attributed to two factors: (1) some respondents who actually follow the mandatory procedure stated on their questionnaire that the source of the allowances was by local development, and (2) some respondents use locally developed allowances in lieu of those furnished by their command.

The differences among the installations can be attributed to four

causes: (1) different interpretations of the terms "personal", "rest", and "delay"; (2) different allowance values used in each category; (3) different methods of developing the allowance values; and (4) different methods of application.

Different Interpretations of PR&D

In their response to question 14 the respondents indicated a wide difference in the interpretation of PR&D allowances. This question listed 13 different items for inclusion in PR&D allowances, even though some do not meet the common definition of the terms. A space was also provided for the respondents to include any other items they felt were pertinent.

The categorization of these items has been summarized in Table 3.

It should be noted that there is not unanimous agreement on the inclusion of any one item in the same allowance category. The closest to unanimous agreement is 98 per cent for inclusion of trips to the drinking fountain and rest room, in the personal allowance.

The inclusion of an item in any of the three allowance categories may make adequate provision for it in the total allowance. However, the differences of opinion as to including an item in the allowance, or not considering it, certainly is a major cause of differences in the allowances granted in the various installations.

Table 3

Items by Category

	Personal	Rest	Delay	Not Applicable
Drinking Fountain	98%		2%	
Rest Room	98%		2%	
Coffee Breaks	49%	37%		14%
Weight Handling	2%	72%	5%	21%
Extreme Heat or Cold	21%	58%	12%	9%
Fumes and Dirt	21%	58%	12%	9%
Machine Breakdowns			77%	23%
Waiting for Material			77%	23%
Waiting for Boxcar or Truck Deliveries			63%	37%
Trips to Credit Union	23%			77%
Trips to Personnel Office	16%		9%	75%
Security Meetings	4%		19%	77%
Safety Meetings	9%		23%	68%

The inclusion of the last four items in Table 3 appears to be an attempt to simplify the installation's man-hour accounting system, since these items are normally reported separately.

Additional items were added to each category by some respondents to allow for special work. These included such items as showers under "personal", and material handling under "rest" where working with explosives. One respondent made the following comment:

> Other elements of nonproductive time that must be considered are: charity drives, bond drives, car registrations, physical examinations, grievance examiner duties, ZD program participation, fire drills, Civilian Welfare Council membership duties, performance appraisal, union activities, ad infinitum.

Several of the latter items which require the worker to leave the work area for long periods of time should be reported separately, and not included in the PR&D allowances.

Different Allowances

The actual amount of allowance granted varies widely among the installations. Seventy-four per cent of the responding installations indicated that they give a standard (constant) personal allowance, which ranged from 2.5 per cent for the lowest to 10 per cent for the most generous allowance. This compares with the 4-12 per cent range for those giving a variable allowance. (See Table 4.) Sixty-five per cent indicated they gave a standard rest allowance, which ranged from 3 per cent to 7 per cent, compared to 0 to 50 per cent

Table 4

Actual PR&D Allowances

	Personal	Rest	Delay
Constant			
Low	2.5 %	3.0%	1.0%
High	10.0%	7.0%	5.6%
Variable			
Low	4.0%	0 %	1.0%
High	12.0%	50.0%	24.0%
Average	5.0%	5.3%	5.0%

for those using a variable allowance. However, only 28 per cent indicated that they gave a standard delay allowance, which ranged from 1.0 per cent to 5.6 per cent. Among the 72 per cent of the respondents using a variable delay allowance, there was a range of 1-24 per cent.

The allowances granted by respondents utilizing variable values are more generous than the standard or fixed values granted by other respondents. The installations using a constant value for all categories averaged 14.4 per cent compared to the overall average of 15.3 per cent.

Different Methods of Measurement

Another factor contributing to the differences in the practices for determining PR&D allowances is the difference in techniques used to develop the allowances. The difference in the use of the various techniques is evident from Table 5. Seventy-nine per cent of the respondents indicated that they use two or more of the techniques for developing their allowances. Several respondents stated that they may use any one method, or a combination of them, depending upon the situation.

Table 5 shows an almost equal use of quantitative methods and subjective methods of measuring allowances for the personal and rest categories, while quantitative methods are used 70 per cent of

Table 5

Techniques Used by Installations to

Develop PR&D Allowances

	Personal	Rest	Delay
Work Sampling	34.5%	30%	46%
Production Studies	14.5%	19%	24%
Tabular Values	3.5%	-	-
Experience	11.0%	18%	15%
Union Negotiation	2.0%	-	2%
Management Decision	34.5%	33%	13%

the time to determine delay allowances. The greater use of subjective measures of developing personal and rest allowances is expected, because of the difficulty of measuring the amount required for those purposes.

Different Methods of Application

The installations also differ in the method by which they apply the allowances. Fifty-five per cent develop the allowance factor by adding the allowances and then adding the percentage to one, as below.

$$\text{Allowance factor} = 1 + \frac{\% \text{ Allowance}}{100}$$

This method is correct only if the allowances have been expressed as a per cent of the productive day. Many installations, however, use this method even though the allowances are expressed as a per cent of the total work day.

As previously indicated, this inconsistency is also evident in the procedure described in appendix B. It is interesting to note, however, that four of the nine respondents using the procedure have recognized the inconsistency and convert the allowances to a per cent of the productive work day, as below.

$$\text{Allowance factor} = 1 + \frac{\% \text{ Allowance}}{100\% - \% \text{ allowance}}$$

Attitude Toward a Department of Defense Policy or Procedure

The receptivity by the installations to a Department of Defense policy or procedure concerning PR&D allowances is important in any future study in this area. This attitude was investigated using three questions. Question 8, "Are the mandatory allowances furnished by higher headquarters adequate?" was designed to determine the attitude of the respondents to command policies and procedures. The response showed that seventy-one per cent of those using mandatory allowances expressed the opinion that the personal allowances are adequate, 60 per cent, that rest allowances are adequate, but only 36 per cent felt that the mandatory delay allowances are adequate.

The attitude toward a suggested uniform policy allowance in the Department of Defense was investigated using question 12, "Do you feel that a uniform Department of Defense PR&D allowance would be applicable to your program?" The majority of the respondents are of the opinion that the allowance would not be applicable, since the proper allowances are a function of the individual situations. The distribution of the response is given in Table 6.

The negative replies were usually supported by statements similar to the two which are quoted below.

Table 6

Attitude Toward DoD Policy Allowance

Allowance	Response	
	Yes	No
Personal	43%	57%
Rest	36%	64%
Delay	29%	71%

Table 7

Attitude Toward DoD Procedure

Allowance	Response	
	Yes	No
Personal	65%	35%
Rest	58%	42%
Delay	54%	46%

> Each installation and area within it benefits from flexibility in PR&D allowance. A uniform Department of Defense policy would detract from the preciseness of standards engineering.
>
> Perhaps for shop work, but ship work is unique and requires special allowances.

A typical response in favor or the policy allowance is:

> This could be used as the base from which we could add or subtract depending upon the conditions found.

Thus, many of those responding "yes" did so with reservations.

The majority of the respondents indicated in response to question 13, "Do you feel that a uniform Department of Defense procedure for determining PR&D allowances would be applicable to your program?", that a uniform Department of Defense procedure would be applicable. The response is summarized in Table 7.

The argument for a uniform procedure is supported by statements such as those quoted below:

> Possibly - any procedure would have to be judged on its own merits.

The negative responses, however, are supported by comments similar to the following statement:

> It is not felt that a uniform procedure can be established. The existing procedure is adequate for our program.

Other statements appear to reflect confusion between a policy PR&D allowance and a procedure for determining PR&D allowances. For example:

> Nobody writes a paper covering all possible situations. Give us a little leeway. Policy should not be mandatory.

The response to these questions reflects the general feeling throughout the study that individual differences between tasks must be considered. The high "no" response to a uniform Department of Defense "procedure" allowance appears to reflect the parochial view of each service and/or installation that they should be allowed to manage their own affairs.

CHAPTER V

RECOMMENDATIONS AND CONCLUSIONS

This study has shown that among the various services and commands in the Department of Defense, significant differences exist between the policies and procedures for determining PR&D allowances.

The 60 installations selected for inclusion in this study were those with established work measurement programs. Of these, 43 responded by completing and returning the questionnaire reproduced in Appendix A. This was a response rate of about seventy-two percent.

Thus, with the possible exclusion of the one command from which there was no response, the findings should be representative of the policies and procedures throughout the Department of Defense.

Conclusions

The decentralization of work measurement responsibility within the Department of Defense has resulted in wide variances in the procedures followed by the installations for determining and applying PR&D allowances. Although differences can be expected in the

allowance values because of job difficulty and environmental conditions, differences in the procedures used often cause inaccurate work measurement standards.

It is unrealistic to compare the performance efficiencies of installations if these performance levels are based on inaccurate standards.

The use of a standard or constant allowance for personal needs, rest, or unavoidable delays assumes that the amount of allowance for these factors is not a variable between jobs or that it is not significant enough to treat it as a variable. However, six of the seven commands providing constant allowances recognized that the allowances do vary between jobs and authorized local adjustment of the allowances. The other command also recognized this variable, but provided for it in part by developing a constant allowance by craft areas, and for single and multi-man operations. It did not, however, make provisions for the effect of environmental conditions such as temperature, humidity and other geographic differences.

Since the installations find it necessary to supplement the constant allowances by adjusting for local conditions, there are no benefits to be derived from the command's providing a constant allowance.

This study indicated that the differences in PR&D allowances resulted primarily from differences in the definition and scope of the

allowances. For example, both at command and installation levels the scope was interpreted by some to include meetings and other similar absences from work.

Although such absences must be considered in determining manpower requirements, they should not be included in PR&D allowances.

The study also revealed considerable inconsistency between the methods of developing the allowances and the methods of applying them. This inconsistency results in significant differences between the allowance actually granted and that which would be granted.[1]

The response to the questionnaire revealed a wide use of subjective methods ("educated guesses") to determine PR&D allowances. The use of these methods can destroy the accuracy of a work measurement standard.

The adequacy of a standard depends not only on measurement or objective determination, but also on its acceptance by the workers. One respondent expressed confidence in the allowances used in his installation "since the allowances are all based on fact and most of all we seldom receive complaints from workers (unions)".

It was also noted in this study that labor unions have no significant influence on the allowances; only one installation reported that

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[1]See discussion of this point on pages 11-13.

allowances were set by negotiation with the union. This is in sharp contrast with practices in private industry as reported by Lazarus[2], who found that in 15 percent of the cases, personal allowances were determined by union-management negotiation; for rest allowances the figure was 13 percent, and for delay allowances, 8 percent.

The installations are reluctant to accept a standard or constant allowance in the Department of Defense for personal needs, rest, and "unavoidable" job delays. However, a slight majority favored a uniform procedure for determining these allowances.

The reluctance by 46 percent of the respondents to accept a uniform procedure is not justified by the respondents' explanations given in support of their answers. For example, one respondent who indicated that a uniform procedure would not be applicable to his work measurement program supported his answer with the statement that "it may have been o.k. initially, but ours has been in use too long; therefore nothing will be gained by changing".

The conclusions from this study are well-summed in a statement made by one of the respondents:

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[2]Lazarus, Irwin P., A New Look at Allowances in Work Measurement, Booz, Allen & Hamilton Sons, Chicago, Dec, 1967.

> There is definitely a need for more uniformity within the work measurement program. Too many installations approach the same problem entirely differently and consequently arrive at separate and distinctly different solutions, none of which may be correct.

Recommendations

The major recommendation which is made as a result of this study is that the Department of Defense provide a common definition of the scope of personal, rest and delay allowances. These definitions should conform to standard practice, and be refined to the point that the commands and installations cannot misinterpret the meaning and scope of the various types of allowances.

It is also recommended that the work measurement program managers provide the necessary guidance to insure that consistency is maintained between the method of developing allowances and the method of applying the allowances[3].

Management should also furnish specific guidelines relating to the conditions or circumstances under which the techniques for determining the allowances may be used. These guidelines should emphasize the importance of measurement of the allowances wherever possible or feasible.

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[3]See Chapter II for a detailed discussion of the commonly accepted definitions and methods of application of PR&D allowances.

Because the personal allowance does not vary with the job difficulty or environmental conditions, it is normally considered a constant. The Department of Defense should specify this allowance so as to provide uniformity between the installations.

The use by some commands of a constant allowance for rest and unavoidable delays should be discontinued because such delays vary with the type of work being performed.

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APPENDICES

APPENDIX A

SURVEY QUESTIONNAIRE

Department of the Army
U. S. Army Management Engineering Training Agency
Rock Island, Illinois 61201

27 February 1969

Your assistance in answering the questions on the attached questionnaire will greatly aid in a study being conducted to determine present practices in developing and applying personal, rest, and delay allowances.

The questionnaire is being distributed to all major DoD organizations having an established work measurement program.

Your answers will be held in strict confidence and no individual organization answers will be reported in any findings.

Since it is expected that the results of this survey may be of interest to you, a summary of the findings will be available upon request after 15 May 1969.

After completing the questionnaire, please mail it in the attached preaddressed envelope no later than 14 March 1969.

ROBERT J. HOWARD
Dept. of Industrial Management
AUTOVON 551-1380, Ext. 6043

SURVEY QUESTIONNAIRE

1. Organization:

2. Job Title:

3. Education:

   -- High School or less

   -- Some college
      Major (specify) _____

   -- Other (specify)

   -- College grad

   -- Major (specify)_____

4. Job background. (Industrial Engineering related)

Job Title	No. of yrs	Type of work

5. Are the Personal, Rest (fatigue), and Delay (PR&D) allowances used by your organization a result of:

   -- Higher Headquarters policy

   -- Local development

   -- Other (specify)

6. Who has responsibility for determining the PR&D policy or procedure in your organization:

__ Higher Headquarters staff Industrial Engineer

__ Local Chief Industrial Engineer

__ Other (specify)

Where higher headquarters have issued mandatory policies and procedures, are you allowed to make adjustments for local conditions?

__Yes __No

For other reasons (specify) __Yes __No

7. Where allowances are developed locally, what techniques are used?

	Personal	Rest	Delay
Work Sampling			
Production Studies			
Experience			
Union Negotiations			
Management Decision			
Other (specify)			

8. Are the mandatory allowances furnished by higher headquarters adequate?

Personal -- Yes -- No

Rest -- Yes -- No

Delay -- Yes -- No

Other (please explain)

9. Where higher headquarters furnishes mandatory allowances, please describe below:

Personal -- Constant _____ % Min

-- Variable (describe) _____

Rest -- Constant _____ % Min

-- Variable (describe) _____

Delay -- Constant _____ % Min

-- Variable (describe) _____

10. Where allowances are determined locally, please describe below:

Personal -- Constant _____ % Min

-- Variable (describe) _____

Rest -- Constant _____ % Min

-- Variable (describe) _____

Delay -- Constant _____ % Min

-- Variable (describe)

11. Do you have confidence in the allowance being used?

Personal	--	Yes	--	No
Rest	--	Yes	--	No
Delay	--	Yes	--	No

Please explain.

12. Do you feel that a uniform DoD PR&D allowance would be applicable to your programs?

Personal	--	Yes	--	No
Rest	--	Yes	--	No
Delay	--	Yes	--	No

Please explain.

13. Do you feel that a uniform DoD procedure for determining PR&D allowances would be applicable to your program?

Personal	--	Yes	--	No
Rest	--	Yes	--	No
Delay	--	Yes	--	No

Please explain.

15. There are two primary methods in use for determining PR&D allowance factors. Check the one you use.

Assume the following allowances:

Personal	5%
Rest	6%
Delay	4%
Total	15%

-- a. Allowance Factor $= 1 + \frac{\%\ \text{allowance}}{100}$

$= 1 + \frac{15}{100}$

$= 1.15$

-- b. Allowance Factor $= 1 + \frac{\%\ \text{allowance}}{100 - \%\ \text{allowance}}$

$= 1 + \frac{15}{100 - 15}$

$= 1 + .176$

$= 1.176$

-- c. Other (Describe)

16. Please make any other pertinent comments.

14. What items should be allowed for under the components of PR&D allowances? (Check proper column)

	Personal	Rest	Delay	Not Applicable
Drinking Fountain				
Rest Room				
Coffee Breaks				
Weight Handling				
Extreme Heat or Cold				
Fumes and Dirt				
Machine Breakdowns				
Waiting for Material				
Waiting for Boxcar or Truck Deliveries				
Trips to Credit Union				
Trips to Personnel Office				
Security Meetings				
Safety Meetings				
Others (Specify)				

APPENDIX B

PROCEDURES FOR DETERMINING PERSONAL, FATIGUE AND DELAY ALLOWANCES (PF&D)

1. Included in this chapter are guidelines generally accepted by the military services/agencies for determining PF&D allowances. The data will be used in conjunction with the development of Defense Integrated Management Engineering System (DIMES) standards.

Production standards determined by time study, work sampling and predetermined time systems do not take into consideration the time spent during a work shift by the employee, for attending to personal needs, rest periods or delays occurring because of conditions beyond his control.

The allowances will be added to the leveled (rate) time to perform an operation and should be arrived at in the most scientific and consistent manner possible. The widely accepted method for developing PF&D allowances is to tailor the situation to fit the particular operation.

The following factors must be considered when arriving at a given percentage allowance.

a. The employee must be allowed time to take care of personal needs (rest room, getting a drink of water, etc.).

b. Poor working conditions (extreme cold, heat, exposure to fumes, etc.) must be considered to the extent that they increase the time required to do the job.

c. Heavy physical effort must be considered also because it influences the time required to do the job. Heavy labor causes an employee to tire more rapidly and will slow his pace throughout the workday.

d. Delays that are beyond the control of the employee. Avoidable delay will not be considered.

2. Allowances for Personal Time

a. Factors for consideration. Consider the surroundings, working conditions, and job requirements which cause the employee to stop work from time to time to attend to necessary personal needs (go to rest room, get a drink of water, get fresh air, etc.). Since most operations allow two breaks of 10 minutes each during the 480-minute shift, the basic allowance for this factor will be 4 percent (19.2 minutes).

b. Allowances:

	Percent Allowances
(1) Basic Allowance	4
(2) Add:	
Class	
(a) Normal office conditions	0
(b) Normal shop, central heat, slightly dirty or greasy.	1

Allowances:	Percent Allowances
(c) Slightly disagreeable. Exposed to weather part of time, poor heating, etc.	3
(d) Exposed to extremely disagreeable conditions most of time. Proximity to hot objects, continuous exposure to disagreeable odors and fumes, etc.	6

(3) Add the following where applicable:

(a) For areas where smoking is prohibited.	2
(b) Where the work period is 8 consecutive hours and 20 minutes lunch period is allowed at the expense of the Govt.	4
(c) Where 5 minutes is allowed at end of shift to return tools to storage or to clean up work area.	1

3. Allowances for Fatigue

a. Physical:

(1) Factors for consideration. Consider the average weight handled per man and the percent of the time that the man is under load. Also, consider the height that load must be lifted.

(2) Allowances. The percent allowances given below are based on handling from a stack at a height of from knee-level to chest-level and placing on a skid at a height from floor-level to chest-level.

Pounds Handled	Percent of time under load 25	50	75	100
0-1	1	1	1	1
1-10	1	2	3	4
11-20	3	5	7	10
21-30	4	9	13	17
31-40	6	13	19	25
41-50	9	17	25	34
51-60	11	22	33	44
61-70	14	28	41	55
71-80	17	34	51	68
81-90	21	42	62	83
91 and over	25	50	75	100

For picking up load from floor, multiply basic allowance by ...1.10

For placing load above chest-high, multiply basic allowance by ...1.20

For getting load from above chest-high, multiply basic allowance by ...1.10

For pushing the load along the floor, multiply basic allowance by ...0.50

(For pushing, in order to determine "pounds handled," estimate pounds of effort required to push the load, not the weight of the load itself.)

b. Mental:

(1) Factors for consideration. Consider the degree of concentration necessary to perform the job and the amount of variety in the tasks. Highly repetitive jobs should be low in this factor.

(2) Allowances:

Class	Percent Allowance
(a) Work largely committed to habit; simple calculations on paper, reading easily understood material such as routine or familiar instructions, counting and recording, simple inspection requiring attention but little discretion, arranging papers by letter or number.	1
(b) Work requires full attention; copying numbers addresses or instructions, memory of number or part name while checking stock or parts list, simple division of attention between work at hand and jobs of others, conveyor or time schedule simple calculations in head, filing papers by subject of familiar nature.	2

Allowances:	Percent Allowances
(c) Work requires concentrated attention; reading of nonroutine instructions, routine calculations on paper such as long division and four-place multiplication, checking numbers, parts, papers, etc., requiring cross check or double check, division of attention between three components such as counting, inspecting and grading or driving over unfamiliar route, watching vehicle, traffic and route signs.	4
(d) Work requires deep concentration; complicated or swift mental calculations, unfamiliar calculations on paper, memorizing, inspection work requiring interpretation and discretion of unfamiliar nature, as when working against nonroutine specifications, highly divided attention between phases of work, operations of others, hazards, etc.	

c. Position:

(1) Factors for consideration. Consider the position which the employees must assume to perform the operation. Select the class which best describes the average

condition. It is assumed that the job will be less tiresome if the position can be varied frequently.

(2) Allowances:

Class	Percent Allowance
(a) Sitting or standing	0
(b) Sitting	1
(c) Walking	1
(d) Standing	2
(e) Climbing or descending ramps, stairs, or ladder	4

d. Monotony:

(1) Factors for consideration. Consider the fatigue resulting from fast, highly repetitive operations. The cycle time is the time elapsed from starting one element until the same element is started again.

(2) Allowances:

Cycle Time	Percent Allowance
(a) 1.0-0.20 min.	4
(b) 0.21-0.40 min.	3
(c) 0.41-0.80 min.	2
(d) 0.81-2.50 min.	1
(e) 2.50 min. or more	0

e. Restrictive Safety Devices

(1) Factors for consideration. Consider those devices which are required by the job and which cause fatigue when worn. No allowance should be made here only if it is necessary to move the devices occasionally for relief, or if wearing them causes fatigue. If more than one device is required, add the allowances.

(2) Allowances:

Class	Percent Allowance
(a) Face shield	2
(b) Rubber boots	2
(c) Goggles or welding mask	3
(d) Tight, heavy protective clothing	4
(e) Filter mask	5
(f) Safety glasses	0

4. Allowances for Delay

a. Factors for consideration. Consider the job in relation to adjacent jobs - how long can any adjacent job be shut down before the job being studied is affected? Also, consider other delays inherent in the job, such as moving from one work station to another, waiting for cranes, etc. No delays which can be prevented by the employee should be considered here.

b. (1) Allowances:

Class	Percent Allowance
(a) Isolated job. Little coordination with adjacent jobs.	1
(b) Fairly close coordination with adjacent jobs.	2

Where employees are required to move from one work station to another to balance adjacent stations, add the following:

	Percent Allowance
Move once each 5 minutes	5
Move once each 30 minutes	3
Move once each 60 minutes	2
Move once each 2 hours	0

For crane waits (where overhead cranes are used to handle material) add 0.10 percent per crane lift per day. Where work is performed on a complicated machine, an allowance for machine down time should be added. This allowance may be arrived at by calculating the normal down time by ratio-delay studies or other means.

5. Examples of Application

a. An employee is unloading boxes from a truck and placing them on a pallet and the following conditions are in effect.

(1) The operation is performed at a warehouse ramp, where smoking is prohibited.

(2) The boxes weigh 25 pounds each and the employee is under load 50% of the time. The boxes are being taken from stacks slightly higher than his head to start with and are placed on pallet resting on the truckbed.

(3) The work is purely routine.

(4) The employee walks approximately five feet with each box.

(5) The cycle time (per box) is .50 minutes.

(6) No restrictive safety devices are required.

(7) A forklift operator is considered a part of the unloading crew and this places the total operation in the isolated job class since the crew is self-sufficient.

Computation of Allowance	Percent Allowance
Personal	
Base	4.0
Class B Slightly disagreeable, exposed to weather	3.0
Add for "no smoking" area	2.0
Fatigue	
Physical - 25 pounds handled 50% of the time. A considerable number of the boxes are handled above the chest level or	9.9

Computation of Allowance	Percent Allowance
at floor level - 9% x 1.10	
Mental - Class A - Work committed to habit	1.0
Position - Class C (walking)	1.0
Monotony - Class C (0.50 min)	2.0
Restrictive safety devices (none)	0.0
Delays	
Class A. Little coordination with adjacent jobs.	1.0
Total Allowance	23.9

If this operation is studied and the cycle time is determined to be 0.555 minutes and the leveling factor is 90 percent, the standard time would be computed as follows:

0.555 x 0.90 x 1.239 - 0.620 standard minutes.

b. Consider a second operation where an employee is packing material in fiberboard cartons for shipment. The following conditions are in effect:

(1) The operation is performed at a work station in a packing area inside a warehouse, where smoking is prohibited.

(2) The internal packs weigh an average of six pounds each and the employee is under load 25% of the time. The material is obtained from tote trays adjacent to the

packing station and is placed on the work table, both are at waist high level.

(3) The work requires the employees full attention.

(4) The employee stands at his work station.

(5) The cycle time (per final pack) is 1.20 min.

(6) No restrictive safety devices are required.

(7) If the flow of material to be packed is cut back, the operation would have to be shut down or curtailed.

Computation of Allowance	Percent Allowance
Personal	
Base	4.0
Class B, Normal Shop, Central Heat	1.0
Add for "no smoking" area	2.0
Add for 5 minute cleanup	1.0
Fatigue	
Physical - 6 pounds handled 25% of the time. The material is handled at waist high level.	1.0
Mental - Class B - Work requires full attention.	2.0
Position - Class D (Standing)	2.0
Monotony - Class D (1.20 min)	1.0
Restrictive Safety Devices (none)	0.0

Computation of Allowance	Percent Allowance
Delay	
Class B - Fairly close coordination with adjacent jobs.	2.0
Total Allowance	16.0

If this operation is studied and the cycle time is determined to be 1.20 minutes with an 80 percent leveling factor, the standard time would be computed as follows:

1.20 x .80 x 1.16 = 1.114 standard minutes.